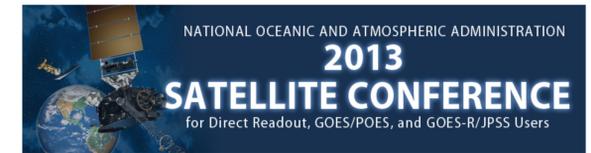




Predicting Severe Weather from Satellite Sounding Pairs

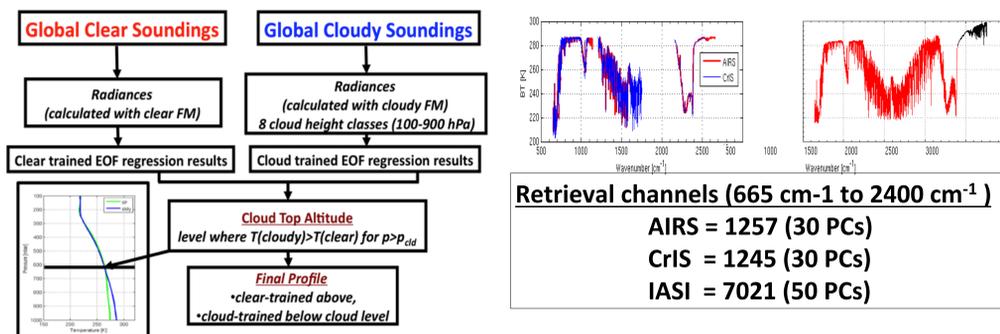
William L. Smith Sr^{1,2}, Elisabeth Weisz¹, Nadia Smith¹

¹SSEC/U. Wisconsin-Madison, ²CAS/Hampton U.



The NPP and the Aqua satellites share the same sun synchronous orbital plane with an equator crossing Local Solar Time (LST) of ~0130 am and pm in ascending and descending nodes, respectively. However, since the two satellites are at slightly different altitudes (i.e., 825 km for NPP and 705 km for Aqua), the same regions of the Earth are observed with time differences varying between zero and fifty minutes during a period of ~2.7 days. The Metop-B and Metop-A satellites fly in a sun-synchronous orbit, at an altitude of about 820km and an equator crossing Local Solar Time (LST) of ~8:45 and ~9:30 am and pm in descending and ascending nodes, respectively. They have a constant time separation time of about 50 minutes. Since the AIRS on Aqua, CrIS on NPP, and IASI on Metop-A and Metop-B are ultraspectral sounding instruments, atmospheric profile time tendency and water vapor flux measurements are achieved from the Aqua/NPP and Metop-A/Metop-B pairs of satellites. Thus, new atmospheric dynamics measurements are available globally four times per day. Vertically resolved water vapor convergence and divergence and atmospheric stability change are important predictors of convective severe weather initiation and tropical storm intensity change

“Dual-Regression” Retrieval Algorithm*



Retrieval channels (665 cm⁻¹ to 2400 cm⁻¹)
 AIRS = 1257 (30 PCs)
 CrIS = 1245 (30 PCs)
 IASI = 7021 (50 PCs)

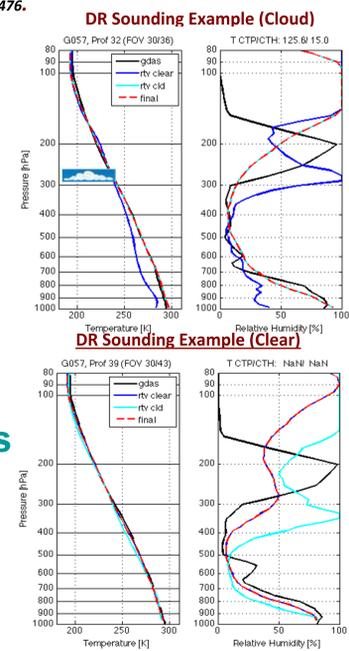
* Smith, William L., Elisabeth Weisz, Stanislav V. Kireev, Daniel K. Zhou, Zhenglong Li, Eva E. Borbas, 2012: Dual-Regression Retrieval Algorithm for Real-Time Processing of Satellite Ultraspectral Radiances. J. Appl. Meteor. Climatol., 51, 1455–1476.

• Ultraspectral Sounders On 4 Satellites

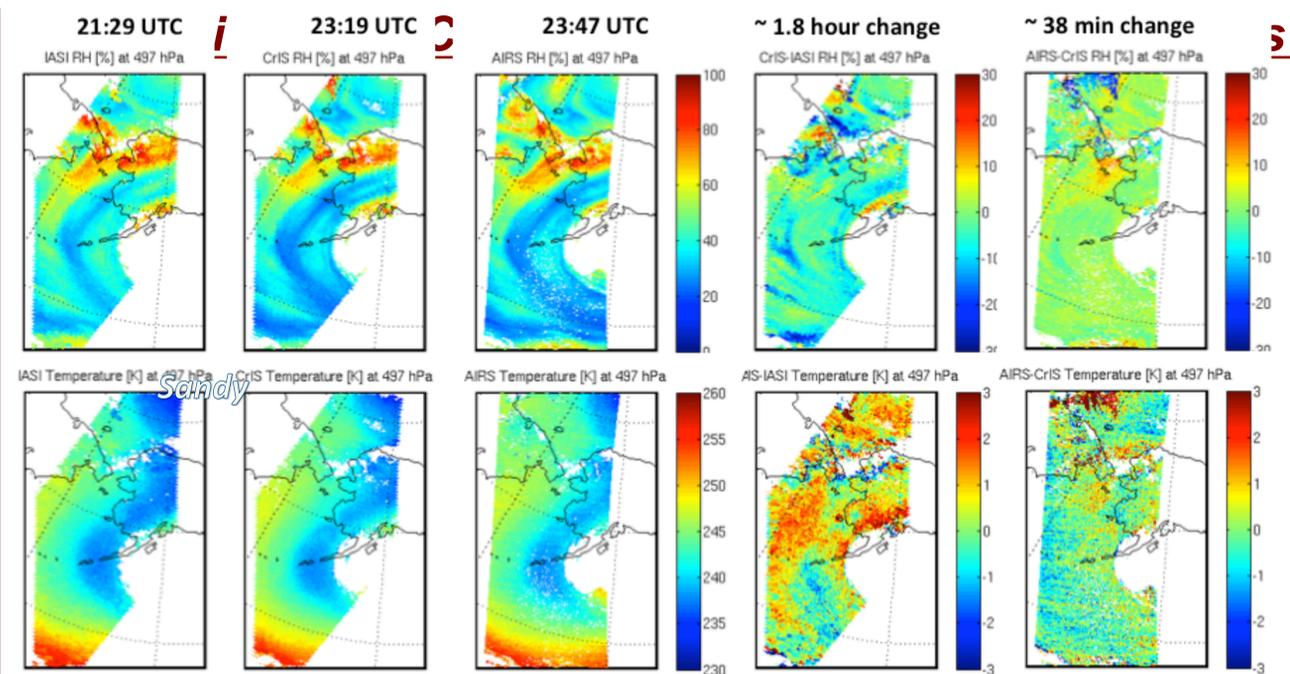
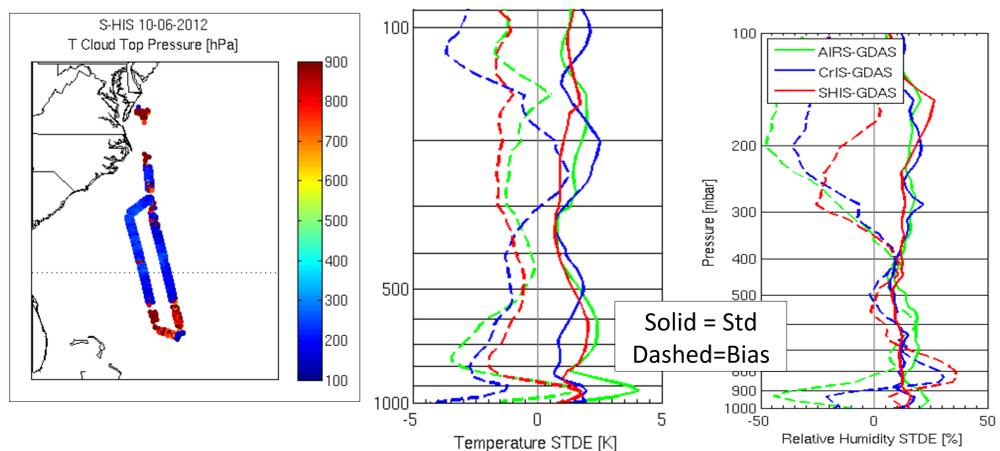
- Aqua/AIRS (13:30 LST)
- Suomi-NPP/CrIS (13:30 LST)
- Metop-A/IASI (09:30 LST)
- Metop-B/IASI (08:45 LST)

• Applications

- Time tendencies of atmospheric variables from consecutive orbits
- Moisture flux
- Pre-convective stability change
- Cloud top height changes related to storm intensity tendency
- Environmental steering currents

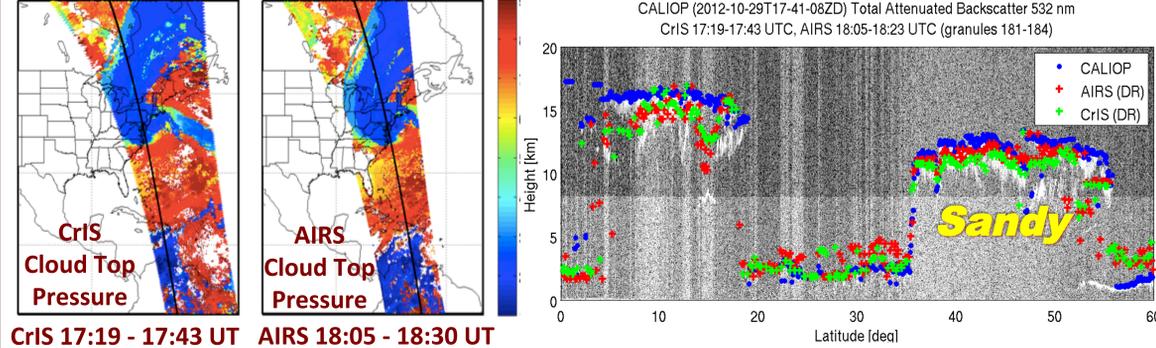


Global Hawk HS3 Validation Flight (Oct 6, 2012)



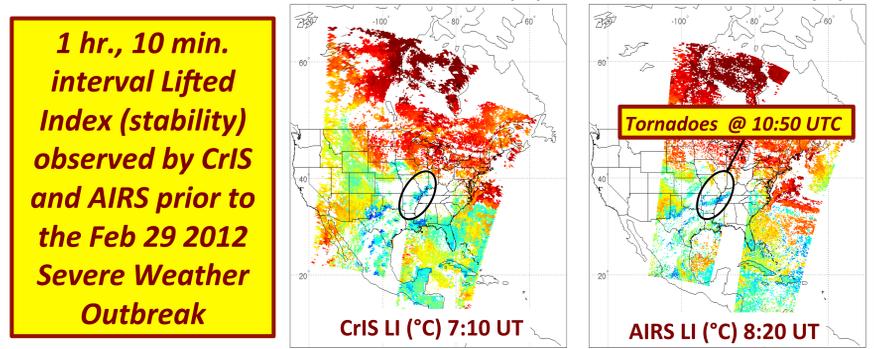
Sequences of IASI/CrIS/AIRS Soundings provide important forecast time tendency observations.

Super-Storm Sandy 45-min Convective Cloud Growth (29 Oct. 2012)



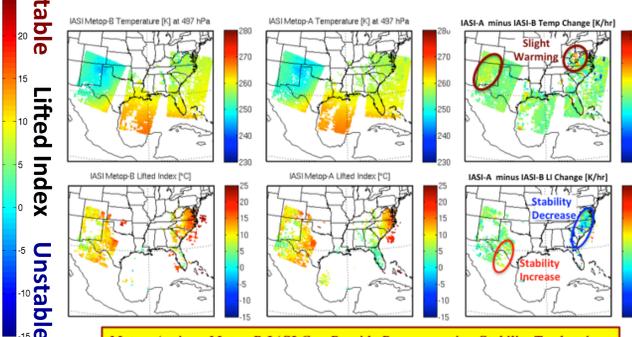
Super-Storm Sandy 45-min Cloud top Height Increase Observed With CrIS and AIRS on 29 October 2012. AIRS Cloud Heights Are Validated using CALIOP LIDAR Measurements

February 2012 Severe Weather Outbreak



1 hr., 10 min. interval Lifted Index (stability) observed by CrIS and AIRS prior to the Feb 29 2012 Severe Weather Outbreak

IASI Metop-B and IASI Metop-A Differences 500 hPa T and LI (10 March 2013)



Metop-A minus Metop-B IASI Can Provide Pre-convective Stability Tendencies